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ON THE PROBABLE OCCURRENCE OF A LARGE AREA OF NEPHELINE-BEARING ROCKS ON THE NORTHEAST COAST OF LAKE SUPERIOR

IN a recent paper in this JOURNAL,[1] Dr. Coleman has described, under the name of *Heronite*, an interesting analcite-bearing rock from near Heron Bay, on the northeast shore of Lake Superior, and states that although the occurrence of a dike rock of this composition would indicate the presence of nepheline syenite in the vicinity, no area of this rock had as yet been discovered in that district. Many years ago, while looking over some of the rock collections in the museum of the Canadian Geological Survey, at Ottawa, my attention was attracted by two specimens of a rather coarse-grained, red rock from Peninsula Harbor, Lake Superior, on account of the fact that their appearance suggested that they might belong to the class of nepheline syenites. Sections were made and examined at the time, but no nepheline was found, and the investigation was not carried further owing to lack of material and absence of information as to the exact mode of occurrence of the rock in question.

In connection with Dr. Coleman's paper, however, it may be well at this time to present a few notes concerning these rocks, as they indicate that the district in question affords a field of much interest for petrographical study.

The first of the rocks in question was collected by Dr. Selwyn in 1882, and is labeled "Peninsula Harbor," while the second was collected by Mr. Peter McKellar in 1870, and is labeled "Mount Point, S.E. side, Peninsula Harbor." They both come, therefore, from the same neighborhood, and probably from the same mass. Unfortunately, the specimens cannot at present be found, so that it is necessary to base the descriptions on the four thin sections in my collection.

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[1] JOUR. GEOL., Vol. VII, No. 5.

The first of these rocks belongs to the class of the augite-syenites, but is of a peculiar type. The augite is represented by two varieties which pass into one another. One is a purplish-brown augite, which frequently constitutes the inner portion of large individuals, and shades away into an outer border of green augite of the second variety. This green augite also occurs in separate individuals. Both varieties have high extinction angles, and the green variety is probably an aegerine-augite. In addition to the augite, a small amount of deep bluish-green and highly pleochroic hornblende is present. The single section of this rock also contains a considerable amount of a mineral which has the high index of refraction and high double refraction of olivine, and which is destroyed by acid with gelatinization.

The feldspars, which with the augites make up most of the rock, consist in part of orthoclase and in part of microperthite, and possibly anorthoclase, and usually possess a zonal structure, an outer border or rim of microperthite often surrounding an individual of orthoclase nearly free from intergrowths. Small quantities of pyrite and magnetite are also present, as also of a deep brown, almost opaque, non-metallic mineral, which is unattacked, even by prolonged treatment, with concentrated hydrochloric acid, and which is probably one of the rarer rock-making minerals.

The structure of the rock is remarkable, and entirely different from that of the ordinary augite-syenites. The feldspars are idiomorphic, and impress their form on the dark constituents, with the exception of the olivine. These latter occupy the interstitial spaces, and are penetrated by the feldspar laths in a manner suggestive of an ophitic structure. The character of the augite and hornblende, as well as the abundance of the feldspar, suggest a magma rich in alkalis.

The second specimen strongly resembles the first, but in it the hornblende replaces the augite, and is present in large amount. This hornblende is so intensely colored that in many cases it is nearly or quite opaque, but when transparent has a deep bluish-green color and a marked pleochroism. It has a small axial angle, and resembles in general character the variety rich in ferrous iron and alkalis described from the nepheline syenites of Dungannon, Ontario, under the name of *Hastingsite*.

The feldspars resemble those of the other specimen, but there is proportionally more microperthite and a considerable amount of an acid plagioclase. Fluor spar is also present, in not inconsiderable amount, in the form of large, colorless grains.

The structure is the same as that of the former specimen, the feldspars being idiomorphic, and the dark constituents occupying the spaces between the feldspar laths.

The specimens, therefore, while not actually containing any nepheline, have the character of certain differentiation products of alkali-rich magmas, which are found associated with nepheline syenites and other nepheline-bearing rocks in other parts of the world.

In the Report of the Geological Survey of Canada for 1846-7, Sir William Logan, after describing certain "traps" of this same district, refers to what is apparently the same occurrence, as follows:

"The rock above and below is composed of brownish feldspar and black hornblende . . . . it is large-grained, and the general mass of the country constituting the Old Pic Point and Island appears to be composed of it. Fluor spar occurs as a disseminated mineral in some of the beds. Judging from fragments on the shore, there are some beds composed of white feldspar and occasional groups of orange red grains of elaeolite, the whole studded with brilliant black crystals of hornblende, forming a very beautiful rock. The general mass of these volcanic overflows weathers to a red, and from a distance may be readily mistaken for the gneiss which underlies the chloritic shales."

Although the rocks in question are here classed as belonging to the traps of the district, in the Geology of Canada published by the Geological Survey of Canada in 1863, they are, in a reproduction of the passage quoted above, referred to simply as "igneous rocks" and nothing is said about their supposed volcanic affinities. In the same publication also, p. 467, the occurrence is referred to as follows:

"On the main shore of Lake Superior, nearly north of the western extremity of Pic Island, is a mass of syenitic rock, composed of red feldspar and hornblende, with zircons which resemble the zircon syenite of Norway." As is well known, this latter rock is an augite-syenite, which in Norway is intimately related to nepheline-syenite.

As all the localities mentioned in this note are near one another on the same stretch of coast, and in the vicinity of Heron Bay, it seems certain that there is in this district a large intrusion of an alkali-rich magma, differentiated into various rock facies, among which there are some containing nepheline and some free from that mineral, and that Dr. Coleman's Heronite is connected with the intrusion in question.

FRANK D. ADAMS.

PETROGRAPHICAL LABORATORY,
McGILL UNIVERSITY.